P.T. Socfindo Research & Development programs

2006 – 2007 SCOPA Activity Report

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P.T. Socfindo Research & Development

Programme

2006 - 2007 SCOPA ACTIVITY REPORT

Task Force, S&T Adviser activities, and general comments

1. Preamble

The object of the Socfindo – Cirad Oil Palm Agreement (SCOPA) signed early 2002 is to renew the cooperation between both signatories. According this agreement, Cirad assigns directly a senior staff to PT Socfindo as Scientific & Technical Adviser, with the approval of the PT Socfindo' Principal Director. The guidance of the Scientific & Technical Adviser activity is advised by the Technical Committee of the SCOPA.

Cirad is providing technical assistance to PT Socfindo in the following fields:

- design, organization, monitoring, analysis and interpretation of results for the genetic improvement programme and commercial seed production, based on results from local trials and from the international network coordinated by Cirad, and on research conducted on the subject by the latter,
- steering of the fertilization programmes for the commercial plantations, through an open-ended experimental network, making it possible to gradually incorporate the latest results and make more cost-effective use of the recommended inputs,
- identifying, programming and implementing any applied research judged necessary to improve crop management sequences for oil palm at PT Socfindo. Such research covers the fields of Agronomy, Genetic Improvement (including biotechnologies and variety creation), and Crop Protection,
- Staff training for both parties,
- Participation, at PT Socfindo's request, in decision-making for technical management of the estates.

2. SCOPA Task Force

2.1. Involved staff

The list includes only the staffs of PT Socfindo or Cirad mainly involved in the activities. Many other staffs have also a part of their activity linked with the SCOPA.

2.1.1. For PT Socfindo

At Head Office:

Ir. Fuad, Agricultural Department
Ir. Xxxxx, Agricultural Department

At Pusat Seleksi Bangun Bandar (PSBB):

Ir. H. Hayun Zaelanie, Manager,
Ir. Indra Syaputra, Chief - Assistant,
Ir. Erwanda Surya, Field – Assistant
Ir. Lalu Firman, Field – Assistant
Ir. Chandra Adi Pasha, Field - Assistant
And 226 employees / contractors for seed production, seeds sale and breeding operations.

At Aek Loba Estate:

Ir. H. Edyana Suryana, Aek Loba Timur Project Chief – Assistant
Ir. Dadang Afandi, Field – Assistant.
And 112 employees / contractors for ALT project laboratory and field operations.

2.1.2. For Cirad

Based at PT Socfindo

J.Ch. Jacquemard, Scientific & Technical Adviser.

Consultants based at Montpellier

T. Durand – Gasselin (Breeding),
H. Hubert de Franqueville (Phytopathology and Ganoderma disease),
L. Ollivier (Crop Protection),

Support at Montpellier

L. Blangy (Seed sale)
B. Cochard (Breeding and consultancy)
A. Flori (Statistic, Breeding data management, storage)
Y. Galouyé (LSU analyse)
J. Ollivier (Agronomy trials analyse, LSU, consultancy)
Xxxxx (Statistic, Agronomy data management, storage)
Xxxxx (Breeding data management, routine analyse)

Consultant based in Indonesia

J.P. Caliman (Agronomy)

2.2. Involved facilities

2.2.1. At PT Socfindo

250 ha of parental garden and germplasm at PSBB
510 ha of progeny and genetic trials from Aek Loba Timur Breeding Project
143.82 ha of collection, seed garden, parental garden and progeny trials from Aek Kwasan II Breeding Project
12 agronomy trials located at Aek Loba, Mata Pao, Negeri Lama, Seumanyam and Seunagan Estates

329 ha of Ganoderma field tests trials located at Mata Pao, Tanah Gambus and Bangun Bandar
1 development laboratory for the implementation of the early test for ganoderma screening

2.2.2. At Cirad

Laboratory facilities (leaf analyses)
Database management for breeding and agronomy purposes

After the scientific re-organisation of Cirad, the Cirad research programmes covering the PT Socfindo Research & Development Programmes and the IPM / BMP targets are split between the following operations:

Involved research units

After the scientific and management re-organisation of Cirad, the Cirad research programmes covering the PT Socfindo Research & Development Programme, the IPM and BMP targets are split between the following departments:

At Cirad – Bios department[1]:

Oil palm breeding - UPR28 (Breeding and seed production)
Controlling pests and diseases in tree crops - UPR31 (Integrated Pest Management)
Development and Improvement of the plants - UMR DAP (Marker Assisted Selection, Vegetative propagation)
Biology and genetic of plant-pathogen interactions - UMR BGPI (IPM)

At Cirad – Persyst department:

Performance of tree crop-based systems - UPR34 (Best Management Practices)

At Cirad – ES department:

Geographic information for agro - environmental management –UMR TETIS (GIS, Remote Sensing)
Functioning and management of tree-based planted ecosystems - UPR80 (BMP, Breeding, Agronomy)
Water management – UMR G Eau (water management)

3. Scientific and Technical Adviser activity

3.1. Introduction

According the article 4 of the SCOPA concerning the role of the Scientific and Technical Adviser, it will be directly involved in the implementation and co-ordination of certain operations, of which both parties will update the list each year, if necessary. Both parties will define the responsibilities of the Scientific and Technical Adviser, those of SOCFINDO and those of CIRAD researchers, for each operation of the annual programme.

[1] Underlined items represent research units with strong interest for Socfindo

3.2. Work schedule for 2006 / 2007

The work schedule for 2006 / 2007 presented has been reviewed according the new presentation of the PT Socfindo Research & Development programmes

3.2.1. Research & Development programme for Agronomy and Field Practices

Support to fertilisation programme

- Support in steering the commercial fertilisation programme
- Assistance to the implementation of new agronomy trials
- Monitoring of the specific observation programme in the concerned agronomy experiments at Aek Loba Estate (ALCP 61, ALCP62, ALCP09)

Field practices, plantation management and mill processing

- Monitoring of the ripeness criteria through specific experiments
- Monitoring of the "Pollinator trees" experiment
- Monitoring of the improvement of the manual assisted pollination
- Support and assistance for the implementation of the GIS programme at PT Socfindo
- Monitoring of the Oil Extraction Rate at Aek Loba Estate through specific experiments
- Monitoring of the improvement of the control of *Mucuna bracteata*

Improvement of the mineral nutrition knowledge of the future planting material

- Monitoring of the ALT Genetic Block fertilisation programme in co – ordination with Agricultural Department and Cirad consultants

3.2.2. Research & Development programme for Breeding and Seed Production

Variety creation

- Breeding programme
    - Monitoring of the crossing maps in co – operation with Cirad consultants
    - Monitoring of the observation related with the MAS programme (ALGP29)
- Aek Loba Timur genetic bloc
    - Monitoring of the Aek Loba Timur Genetic Block activities
    - Monographs of ALGP02, ALGP03 and ALGP04
    - Monographs of ALGP06 to ALGP10
- Aek Kwasan II project
    - Monitoring of the operations (work programme, germination, prenursery, nursery, field preparation, plantation) with all involved operators (Head Office, PSBB, Aek Loba, Cirad)

Variety propagation

- PSBB

    - Follow-up and assistance in implementing the seed production programme (Bangun Bandar), respecting instructions specific to such production,
- Aek Kwasan II
    - Preparation of the transfer of the seed production activities to Aek Loba
    - Implementation of the new seed garden
- Participation to the new Vegetative Propagation laboratory creation

3.2.3. Research & Development programme for Crop Protection

Integrated management of the BSR

- Follow – up and assistance to the observation in the Gano 1, Gano 2 and Gano 3 located at Mata Pao, Bangun Bandar and Tanah Gambus
- Monitoring of the observation in the Aek Loba Timur Genetic Block

Integrated management of *Oryctes* and other pests

- Preparation of a specific R&D programme to control the *Oryctes rhinoceros* in the Socfindo estates in co – operation with the Cirad consultants and the industry
- Implementation of the biological control of *Oryctes rhinoceros* at Aek Loba

Integrated management of the fruit set

- Monitoring of the *Elaeidobius kamerunicus* population, preparation of a specific R&D programme to follow – up the seasonal variation of its population in co – operation with the Cirad consultants and the industry

3.2.4. Research & Development programme for Environment, Social and Sustainability

Integrate the RSPO principles and criteria in the PT Socfindo management and field practices

- Preparation of the integration of the principles and criteria for SPO in the management and field practices at PT Socfindo
- Participation to the identification of the indicators needed to evaluate the SPO principles and criteria
- Participation to the implementation of ISO14000 procedure
- Participation in technical meetings, customer visits, etc, whenever useful or desired, at PT Socfindo' request

Develop new projects taking in account the Environment protection

- Participation to various projects (BACP, PanEco)

3.2.5. Publications, Conferences and general reports

3.3. 2006 / 2007 Activities[2]

3.3.1 Agenda

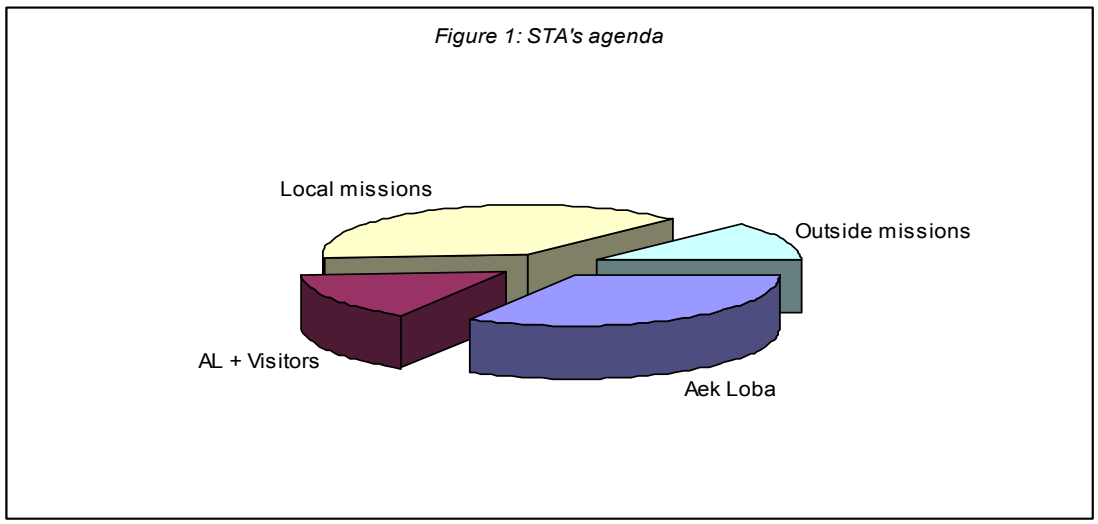
The TABLE 1 summarise the STA's agenda since July 2006.

TABLE 1: 2006 – 2007 STA's Agenda (in days)

Month	STA's agenda				Cirad Consultants received
	Aek Loba	AL + Visitors	Missions		
			Local	Outside	
July-06	1	4	3	5	7
August-06	6	1	2		
September-06	16		8	4	
October-06	3	4	16		12
November-06	8	3	13	4	31
December-06	3	4			2
January-07	3		3		
February-07	11	4	11		8
March-07	10	4	8	10	8
April-07	5	7	15		26
May-07	7		5		
June-07	6.5	5.5	15.5		27
July-07	7	3		9	
Total	86.5	39.5	99.5	32	121
%	34%	15%	39%	12%	

For the period July 2006 – July 2007, the STA's Agenda *(Figure 1)* is shared between 2 nearly equal parts: 49% of the time at Aek Loba and 51% of the time outside Aek Loba, but 66% of the STA's time is dedicated to visitors (Cirad and non – Cirad), local missions and participation to conferences. At Aek Loba, a third of the time is devoted to visitors. The cumulative number of days for Cirad Consultants missions reaches 121.

Figure 1: STA's agenda



[2] For each section, in addition to the STA's activities, a general progress status and comments are delivered. Of course, these activities involve also Socfindo teams

3.3.2. Research & Development programme for Agronomy and Field Practices

Support to fertilisation programme

- Support in steering the commercial fertilisation programme

The STA participated to the Consultant field visits in the Group II (Mata Pao, Bangun Bandar and Tanah Gambus) and in the group III (Aek Loba and Padang Pulo). He is fully involved in the J. Ollivier "companion" programme. A new set of fertilisation tables has been produced by the consultant after theses visits. A fine tuning has been done by Agricultural Department.

- Assistance to the implementation of new agronomy trials

In 2006 – 2007, there is no new experiment implemented. But, after a specific field visit of ALCP08, the future of this trial is questionable. All data and files have been given to J. Ollivier to help him to realise a summary report on the last 5 years of results. The analyse of the boron deficiency symptoms recorded on ALCP07 material has been presented at the last Oil Palm conference (Bali – 2006).

- Monitoring of the specific observation programme in the concerned agronomy experiments at Aek Loba Estate (ALCP 61, ALCP62, ALCP09)

ALCP61 / ALCP62
A specific set (incomplete design) of bunch analyses prepared according the Consultant proposal shown a significant effect of the fertilisation on the bunch quality. Fertilisation application reduces significantly the following characteristics: Average Bunch Weight, Average Fruit Weight, Mesocarpe to Fruit, Oil to Mesocarpe and Oil Extraction Rate. It increases the kernel Extraction Rate. A full set of bunch analyses, started last March, is in operation (2 years programme) to confirm or infirm these results.

ALCP07

The boron nutrition and deficiency symptoms according the progenies tested in this trial has been presented last year at the International Oil Palm Conference Bali (JACQUEMARD *et al*, 2006. Boron is an important trace element in the physiology of the oil palm. In the transport of carbohydrates, protein synthesis and energy transfer reaction, its deficiencies have spectacular effects. The deficiency occurs frequently in young trees, and in the most favourable ecologies in Indonesia in which the palms grow well.

In ALCP 07, fertiliser trial implemented at P.T. Socfindo Aek Loba Estate with 4 different progenies closely genetically linked, a new type of Boron deficiency symptom appeared very early. Mainly this affected only one of the four progenies where the Boron deficiency status was recorded regularly. In fact, 3 types of symptoms of Boron deficiency have been recorded. It appears that the expression of Boron deficiency symptoms derives more from the genotype affected than the level of the element in the leaf.

Observations recorded in commercial areas and in progeny trials, confirming the link between type of boron deficiency expression and genotype are also discussed in the paper.

ALCP09

The phenotypic measurements show significant differences between the progenies – despite their unique origin (S6325). A general overview and the comparison with ALCP10 (same age, same soil, same category) seems indicate that the fertilisation policy at immature stage could be reviewed (in the sense of more fertiliser application).

BOX I:
In our point of view, it seems that the fertilisation level is too low at the young adult stage (4 to 6 years old). The fertiliser schedule has been reviewed in that purpose. Despite a strong increasing of the boron fertilisation at immature stage, boron deficiency symptoms do not disappear. The effect of planting material and / or field application is questionable. In some estates, the mechanised fertilisation proposed by JP Caliman to optimise the schedule of fertiliser application is running. EFB (despite possible interaction with *Oryctes* populations) as decanter solid applications start to be extended to all estates.
There is a strong demand to back to a fertilisation policy based to maintenance / corrective doses avoiding to heavy fluctuation between years and anticipating the crop.
It will be useful to have at Socfindo disposal an annual document taking stock of the commercial mineral nutrition analysing the last 3 campaigns. For next Scopa meeting, Cirad will produce a document summarising the agronomy trials results at PT Socfindo.

Field practices, plantation management and mill processing

- Monitoring of the ripeness criteria through specific experiments

4 experiments are still running on this topic:

  - Evolution of the bunch characteristics through the year (based on two batches of clones)

In addition to the recloning effect detected in this experiment, fluctuation of OER through the year is confirmed. This fluctuation is quite strong from 21.1 % to 25.9 %. The correlation analyse establish that an effect hierarchy of the bunch components could be addressed from higher to lower correlation:

Fruit to bunch (0.90***)
Average bunch weight (0.71***)
Mesocarpe to fruit (0.58**)
Oil to mesocarpe (0.49*)

Fruit to bunch explain 80% of the fluctuation of the OER, the other characteristics explaining 30% or less of the fluctuation.

- Evaluation of the number of detached fruits before and after harvesting in commercial conditions

In Aek Loba conditions, the final number of detached fruits is more of less 5 to 7 times more than the number of detached fruits before harvesting. The maximum of detached fruits could reach 350 to 400 fruits where the number of fruits on the ground exceeds 35 units. That confirms the strong interest of the "3 loose fruits on the ground" criteria in term of fruit collection.

- Evaluation of the dynamic of maturation

During the maturation, the number of fruits increases by 5 times each day after the first detached fruit in average. Thus, after 6 to 8 days, corresponding to the interval between two rounds of harvesting, the average number of detached fruits reaches 19 to 32 with a minimum of 1 detached fruit and a maximum of 170 detached fruits. In conclusion, the criteria "3 loose fruits on the ground" reduce by 50% the number of fruits to collect compared to "1 fruit / kg" criteria without evidence of effect to the OER.

- Study of the bunch components and OER on commercial blocks at Aek Loba and Padang Pulo Estate

Mid-term data are available for this study. Some conclusions could be delivered:

OER appears at its optimum in N4
OER per categories appears significantly different from 23.3 to 26.9%, but the number of analyses remains low for some of them
OER at Aek Loba Timur divisions appears slightly lower than the other divisions (age, or soil quality, and / or climate conditions)
S6305 category has been planted from 1992 to 2002. After 1998, the analyses show an increasing of the OER for 0.6 point from 24.4 to 25.1 % and a decreasing of KER of 0.6 point from 4.1 to 3.6 %

- Monitoring of the "Pollinator trees" experiment

As in initial experiment, the pollinator tree concept works properly in AL ES 05. After two cycles of pruning, the main conclusions are:

The emission of male flowers occurs between 10 to 17 months after pruning with 1.5 male inflorescence per month
Despite the origin of the pollinator trees (Pure Deli), a significant proportion of the trees (30 to 40%) given lower number of male inflorescences
The competition effect with surrounding commercial palms remains questionable

Thus, the concept is interesting, but needs further investigations (planting materials, competition effect, reactivity of the trees in all ecologies)

- Monitoring of the improvement of the manual assisted pollination

TABLE 2 shows the comparative running costs for assisted pollination and the first estimation of the pollinator tree concept. Input represents the value of the estimated increasing of the average bunch weight.

TABLE 2: Running Costs

Assisted pollination					Pollinator tree		
section	Out Put	US$/ha/day	per year	Input US$/ha/day	Section	US$/ha/day	per year 12 trees/ha
Workforce	0.2md/ha	0.8989	269.6629		Nursery		4.044944
Mandor	0.01md/ha	0.0562	16.8539		Planting		0.431461
Talkum	100gr/5 ha	0.0045	1.3483		Workforce		1.078652
Pollen	20gr/5 ha	0.0719	21.5730		Poisoning		0.337079
equipment	33.7 US$ / year / team	0.0112	3.3708		Workforce		0.539326
pollen preparation	56.2/month	0.0028	0.8427		Fertlisation		14.44674
		1.0455	313.6517	3.3708		0.0696	20.8782

- Support and assistance for the implementation of the GIS programme at PT Socfindo

The GIS experienced at Aek Loba and Padang Pulo under Arcview® is now in extension to the other estates. To date, the mapping is ready for the following estates:

In the group I: Seumanyam, Seunagan, Lae Butar and Sungei Liput
In the group II: nil
In the group III: Aek Loba and Padang Pulo

- Monitoring of the Oil Extraction Rate at Aek Loba Estate through specific experiments
-

This operation is in stand-by for the moment.

- Monitoring of the improvement of the control of *Mucuna bracteata*

A chemical control of *Mucuna bracteata* has been validated. It uses a mixture of 3 g of Metafuron and 50 ml of Crash (). Applications could be operated from N_0 with a spray limited to the external part of the circle in prevention of invasion from *Mucuna* and on the path. The periodicity could be monthly during the wet period and twice a trimester during drier periods.

<u>Improvement of the mineral nutrition knowledge of the future planting material</u>

- Monitoring of the ALT Genetic Block fertilisation programme in co – ordination with Agricultural Department and Cirad consultants

After evaluation of the mineral nutrition of all genetic trials at Aek Loba Timur, the fertilisation and the possible relationship with the yield, we have proposed a new set of fertilisation schedule for the genetic trials taking in account the following factors:

BOX II:
Recurrent fruit set problems have been pointed in Socfindo estates since many months (years). It appears that Negeri Lama and Mata Pao are more frequently affected. Last 30th November, the mill manager from Mata Pao gave a proportion of bunch with poor fruit-set reaching 6 to 9 %. Few years ago, the extraction rate at Negeri Lama dropped 3 to 4 points during many weeks. The problem there has been underlined again this year and limit the performance of NL Mill compared to Aek Loba, for instance.
According discussions with the management and information collected, the fruit set problem cannot amount to a simple problem of assisted pollination. On same time, fruit set is the main factor affecting the extraction rate at Socfindo (ALES 06).
The phenomenon result in many bunches presenting a "broccoli" aspect with one or two, some times more, ring of empty spikelets on their base.
Recent data collected at Mata Pao shown that a simple ablation of the spathes before and / or at time of anthesis of the female inflorescence allows an increasing of 22 % of the ABW.
The complex fruit-set / assisted pollination / pollinator fauna involves several disciplines as Agronomy, Breeding, Entomology and Ecology. Thus, it is studied through several connected operations from all of R&D programmes. Higher density at young age coupled with thinning should be investigated as shorter life cycle palms which seem generally less susceptible to poor fruit set problems.
GIS programme should be emphasised to achieve the mapping of all estates (including the rubber ones). It will be beneficial not only for agronomy and management purpose but also for the monitoring of BSR (See R&D programme for Crop Protection).

Mineral nutrition – genetic relationship
Fertility of the soil
Level of calcium nutrition
Cation balance

Thus, new tables have been proposed for each element based on the following bottom line:

Urea:	2.5 kg
Rock Phosphate:	1 kg
KCl:	2.5 kg
Dolomite:	1.5 kg

The following TABLE 3 summarises the proposal:

TABLE 3: Fertilisation levels on Aek Loba Timur genetic block

Level of fertilisation	Nitrogen	Phosphorus	Potassium	Magnesium	Boron
High	GP 24 – 25	GP 9, 20 and 27	ALGP 16, 17, 18 and 23	GP 02, 06, 09, 11 and 27	Other trials
Medium	Other trials	Other trials	Other trials	Other trials	GP 09, 11, 13, 20 and 27
Low	GP 15, 16, 17, 18 and 23		GP 02, 03, 04, 06, 07, 09, 11, 13, 14, 15, 20, 21, and 27		

BOX III:
This fertilisation management could be implemented for validation at experimental level on one of the estates.

3.3.3. Research & Development programme for Breeding and Seed Production

Variety creation

- Breeding programme
  - Monitoring of the crossing maps in co – operation with Cirad consultants

To date, nearly 100 crossing maps are running at PSBB to achieve the breeding programme. The following TABLE 4 summarises their objects:

TABLE 4: Running crossing maps at PSBB

Object	Number of crossing maps	Object	Number of crossing maps
AKII part 0	5	Backcrosses	2
AKII part I	6	Seed Garden	26
AKII part II	8	Parental Garden	5
AKII part III	4	Collection	14
AKII part IV	6	GANO 4	23

4 crossing maps from AKII part 0 should be closed soon.

  - Monitoring of the observation related with the MAS programme (ALGP29)

ALGP 29, planted in 2003 on good and flat soils in Division 2 at Aek Loba, has been specially designed for Marker Assisted Selection (MAS) under the INCO-DEV Link2Palm project. Censuses of Crown Disease, abnormalities and / or other problems have been done once a year. In next January, individual recording will start.

BOX IV:
Socfindo and Cirad are involved in three genomics projects: Marker Assisted Selection (ALGP 29, Bio 2 and Bio 3), Certipalm and Identity (ID) project. Socfindo is waiting for full proposals from Cirad concerning:

- Use of MAS in R&D programme for breeding and the observation to realise on ALGP 29
- Vision, costs and programme at short and medium term, including transfer of technology for ID project

Socfindo expects a development project from the recent advances of Certipalm.

Concerning the "Identity project", the full procedures for sampling, blending, recording and controls have been written with Cirad expert (Mrs Pomiès) during her mission last June. The project cannot be implemented at Tanah Gambus, thus its new location will be examined soon with Socfindo Management.

- Aek Loba Timur genetic bloc
  - Monitoring of the Aek Loba Timur genetic block activities

The routine programme of observation on Aek Loba Timur genetic block includes:

Half-yearly Ganoderma census
Annual tree survey
Individual recording of the yields from 3 years old
Bunch analyses from 5 to 6 years old (eventually later)
Biennial leaf content analyses per progeny
Trunk height at 6, 9 and 12 years old
Canopy bulkiness at 10 years old
Leaf area parameters at 10 years old

In addition, since last March, a weekly census of the male inflorescences in anthesis has been generalised on all trials, including the recently planted at AKII.

The yield potential in terms of CPO / ha / year of the best progenies from 1995 and 1997 plantings could be summarised through the following *Figures 2 and 3*. The Figures show the respective tenancy of the 3 best progenies compared to the mean of the trials.

Figure 2: CPO in tons / ha in 1995 Planting (12 months)

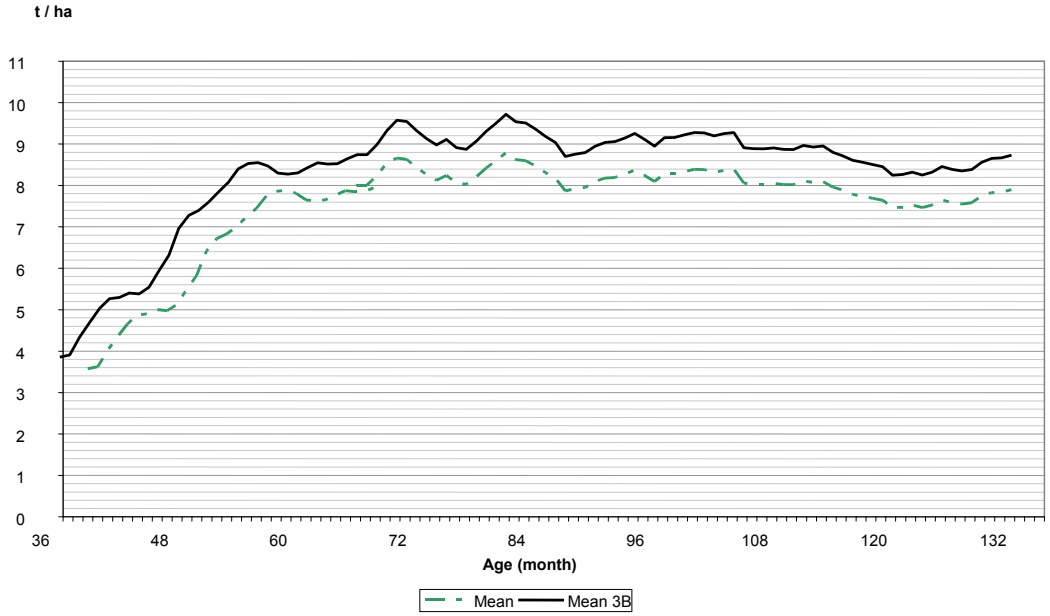
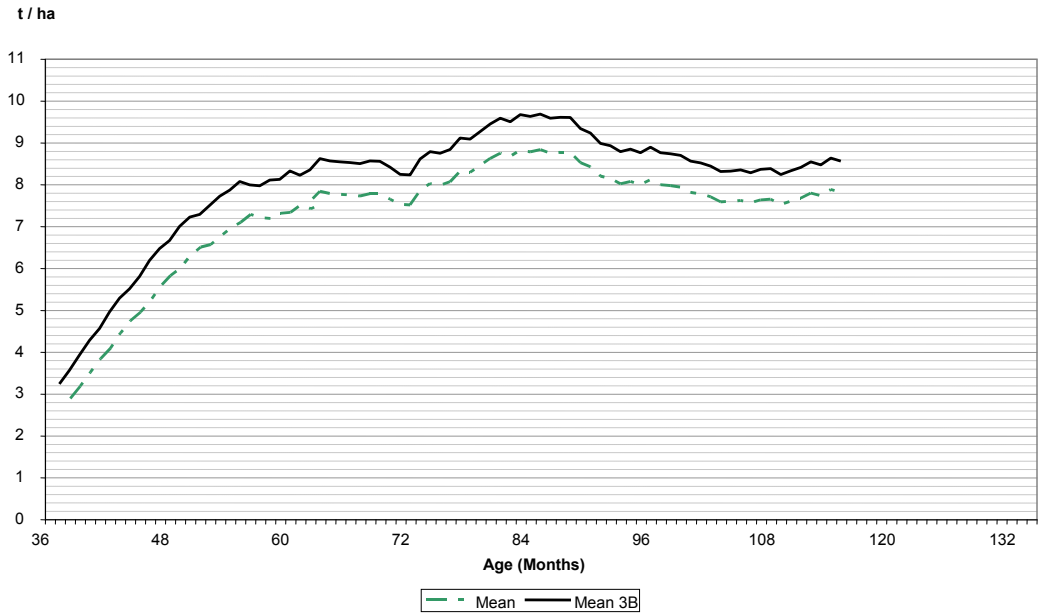


Figure 3: CPO in tons / ha in April 1997 planting



- Monographs of 1995 – 1997 plantings

The monographs of ALGP 01, ALGP 02, ALGP 03 and ALGP 05 have been completed. The interest to evaluate the fluctuation of the FFB yields between years is confirmed. For some progenies, this fluctuation could exceed 10% of the mean, which is considerable in North Sumatra conditions. The character seems independent from the potential.

For some types of materials, it appears a significant co-relation between the trunk height at 6 years old and the FFB yields at 6 – 9 years old. It could indicate that for these types, which are slow growth starter, the full mature stage is achieved later than the others.

Results and analyse from ALGP 05 (clone test) have been presented at the International Oil Palm Conference last year at Bali (NOUY *et al*, 2006). Ortets were selected from excellent progeny studied at the La Mé and Aek Kwasan research stations. The clones obtained from these ortets were evaluated in direct or indirect comparative trials with their original cross and with sexual crosses from new breeding cycles. The observations made so far show that the clones have the same characteristics as the ortets in terms of mesocarpe / fruit, oil / mesocarpe and, to a lesser extent, fruit/bunch. However, the production of bunches at a young age was not nearly as good as that of the ortets and even those of the original crosses. The clones' level of production seems to improve after 6 years. However, few clones had exceptional production characteristics and those that did were inferior to the best sexual crosses from the last breeding cycles.
Are these clones really the exact replica of the original ortets? The observations showed that the trees were apparently normal and presented no visibly discernable "mantled" or vegetative anomalies. However, it is possible that there were epigenetic modifications as a result of the process of *in vitro* culture, which could have affected other parts of the genome. An example is given for one clone in which the recloning of two individuals produced two theoretically identical groups of palms: there bunches had significantly different characteristics, such as: average weight and the percentage of fruit on the bunch. In general, the bunch low production and the percentage of fruit on the bunch (although relative), could be due to "silent" epigenetic anomalies.

- Other results

More recently, the male inflorescence production observed at Aek Loba Timur shows that (i) the dura palms in D*T crosses produces more male inflorescences than the tenera palms (ii) there is huge differences between progenies, thus between progenies and clones. It seems that, by simulation for the current planting materials produced, (D5D * D3D) * LM2T could present under the most favourable condition high risk of bad fruit-setting for a longer period than the other types. Nevertheless, this new factor must be investigated deeply.

- Aek Kwasan II project

  - Monitoring of the operations (work programme, germination, prenursery, nursery, field preparation, plantation) with all involved operators (Head Office, PSBB, Aek Loba, Cirad)

Aek Kwasan II project is progressing surely. TABLE 5 summarises the progress.

TABLE 5: AKII project progress

Year	2004	2005	2006	2007	2008	% Target
Progeny Trials (nb)	0	2	5	8	4	73%
Parental Garden (ha)	0	5.38	5.53	39.24	25.6	36%
Collection and other (ha)	1.17	2.06	1.40	2.19	2.70	95%
Seed Garden (ha)	0	8.18	7.73	15.08	4.80	32%

BOX V:

The best way to summarise Socfindo and its customer's requirements as recorded since two years is to report our "Challenges for sustainability" chapter from our next communication to PIPOC 2007:
The Round Table for Sustainable Palm Oil (RSPO) specifies three components of sustainability – environmental, societal and economic. Economic sustainability more problematic and must be enhanced by further improvements in production efficiency (WOOD, 2007).

Then, the guidance of Principle 3 of the RSPO Principles and Criteria of sustainability (Commitment to long – term economic and financial viability) underlines the requirements for the business or master plans of a plantation company to afford particular attention to the quality of planting materials. The professionals of the Industry and their boards are more and more aware about this necessity. In their relationship with the seed producers, they point out very frequently their requirements that their own needs should be taken into account. The challenges for the future remain to achieve more productive planting material. Commercial figures and research data exposed above provide the prospect of yield exceeding 8 to 9 tons CPO / ha / year in commercial conditions within the next two decades. But, if OER and FFB remain obviously the corner stones of the quality of the planting material, other characteristics must also be considered:

- Palms better adapted to specific environmental conditions

Where the development of the industry in a large country like Indonesia expects development of 9 million ha of oil palms as an objective, it is certain that a large part of the oil palms established cannot be only under the best agro – climatic conditions.

- Tolerance to various stress factors such as drought, wind, temperature, etc.

Global warming, the regular occurrences of El Niño / La Niña phenomenon… have long trend implications which should be investigated to study there effects on the potential of the planting material.

- Palms better adapted to specific nutrient requirements

The huge demand on the fossil energy, and the over – exploitation of the rock fertilisers, are a clear sign that the cost of the fertilisers increases substantially in future. Fertilisers are a major input requirement for the successful production of palm oil. A more efficient planting material requiring less fertiliser should be an advantage.

- Resistance or tolerance to specific diseases and pests, such as *Ganoderma*, *Fusarium* wilt, *Oryctes*, etc.

Indonesia and Malaysia enter now in replanting cycle of their large industry. The African experience of Wilt disease shows that a genetic answer to limit the spread and the economical effect of such diseases is possible. Genetic adaptation of the planting material should be also a part of best management practices (BMPs) as several studies on the link between planting material and pest spread is apparent.

BOX V (Cont.):

- Economic considerations such as; fast/slow growth, height increment, high bunch number/low weight or low bunch number/high weight, high extraction/lower bunch weight, sex ratio, CPO/PK ratio, compact palms, etc.

- Downstream or end-user requirements such as olein/stearin ratio, Iodine Value and carotene content, etc.

For these two last points, the large variability available in the genetic resources allows the supplying of specific niche markets with very adapted planting material. It is obvious that the Industry would like be involved in the choice of the planting material bought from the seed producers according to specific requirements such as cited above. Thus, the Industry now requires a more formal and precise information from the breeders and seed producers about the qualities of the proposed planting material to be sure that it could fulfil these requirements.

The new characteristics should contribute to more efficient and precise agriculture. But, the market, and its constitutive stake – holders, must not forget that the breeders need 15 to 20 years to deliver a new variety; the breeders should not forget to maintain sufficient diversity in their offer; and finally the Industry should not forget to organise their plantation and the tracking of the material planted to be prepared to provide precise information on requirements to the seed producers.
The current status of the exchange of germplasm with Pobè is summarised as follow (in term of exchanged genitors):

Realisation of Germplasm Exchange with Pobè

	Pobè to Socfindo		Socfindo to Pobè	
	A group	B group	A group	B group
Seeds	45%	0%	70%	100%
Pollen	62%	42%	92%	100%

If the progeny trials and collection programmes are progressing well, the seed garden and the parental garden are moving slowly than expected. It will be probably difficult to achieve these parts of the project in 2010.

Variety propagation

- PSBB
  - Follow-up and assistance in implementing the seed production programme (Bangun Bandar), respecting instructions specific to such production.

Socfindo is certified ISO 9001 – 2000 since November 2001 for its seed production at PSBB. The current potential of commercial seed production reaches 45 million dry seeds. It is based on the exploitation of 7500 dura palms and 395 pisifera palms. Some types of planting materials, as Wilt tolerant materials, remain under import of specific pollens necessity. Socfindo produces 73 % of Deli * La Mé categories and 27% of Deli * Yangambi categories.

The current programme exploit general combining abilities of genitors selected from Cirad network, Aek Kwasan and Aek Loba Timur breeding blocs. In the A group, 44% of the mother trees come from good or excellent genitors tested at Aek Loba Timur and 24% from Aek Kwasan breeding bloc. 69% of the genitors comes from DA5D*DA3D, DA115D or LM404D*D10D. DA5D*DA3D is represented by 3 parents, DA115D by 8 parents – including LM3005D, which is susceptible to Ganoderma and LM404D*DA10D by 4 parents.

In the La Mé B group, 67% of the pisifera palms come from good or excellent trees tested at Aek Loba Timur breeding bloc. There is no representation of the B parents rested at Aek Kwasan. 71% of the pisifera palms come from LM2T*LM10T, LM10T selfed and LM5T*LM10T. LM2T self is represented by less than 3% of the pisifera only.LM2T*LM10T is represented by 4 second cycle genitors, LM10T selfed by 3 parents, including PO3281T, which seems to be susceptible to BSR and LM5T*LM10T by 5 parents.

In the Yangambi B group, 66% of the pisifera come from excellent parents from Aek Loba Timur genetic bloc. 73% of the pisifera palms come from LM718T*LM238T, which is represented by 5 parents.

BOX VI:
None yet achieved study shows that only very few seeds come from Specific Combining Ability. The seed production programme is based on General Combining Ability, but for many combinations, the A and B group families have never been crossed. Thus, we have no idea about the effect of the 20% non additive part on the quality of the seeds and the precision of the information that we deliver to our customers. It is obvious in the field that unacceptable characteristics appear like fruits at the extremity of the spikelets, abnormal palms, and stubborn boron deficiency. The large presence of *Curvularia* in the AKII seed garden and parental garden nursery is also worrying for the future. As underlined in BOX V, Socfindo and its customers require more precise information about the planting materials. Cirad should advise Socfindo and propose all means to minimise the effect of the non additive part in the seed production.
Of course, the requirements expressed in BOX V are also addressing the seed production.

- Aek Kwasan II
  - Preparation of the transfer of the seed production activities to Aek Loba
  - Implementation of the new seed garden

See Aek Kwasan II project progress. From now, the achievement of the new seed garden is the first priority.

- Participation to the new Vegetative Propagation laboratory creation

Since September 2005, Socfindo agreed with the principle to open a Vegetative Propagation Laboratory for the multiplication of oil palm and rubber trees. Concerning the oil palm part, Socfindo specifications has been confirmed as following:

- Opening of a small R&D laboratory studying:
  - The efficiency of the new procedure in Socfindo conditions
  - The conformity of the clones in Socfindo conditions
  - The strategy to choose / to prove the clones

- Produce clones for Socfindo estates
- Eventually, sell some ramets to dedicated customers to evaluate the clones in various environments.

BOX VII:
Since September 2005, Socfindo is waiting for a proposal concerning the oil palm part conformed to exposed requirements. It seems that Cirad cannot make any proposal for the rubber part. Thus…

3.3.4. Research & Development programme for Crop Protection

Integrated management of the BSR

- Follow – up and assistance to the observation in the Gano 1, Gano 2 and Gano 3 located at Mata Pao, Bangun Bandar and Tanah Gambus
- Monitoring of the observation in the Aek Loba Timur Genetic Block

The results of the observation done at PSBB, Aek Loba and Mata Pao have been evaluated and the AKII programme has been reviewed last November with the consultants to take in account new evidence of susceptibility of some parents.

BOX VIII:
The accumulation of data from Aek Loba Timur, Gano projects, and those recommended by H de Franqueville on commercial estates needs to be supported by a specific body at Socfindo Agriculture Department in charge of the GIS management. This body should ensure also the management of the commercial database for agronomy (GIS)? Thus, Socfindo is waiting for Cirad proposal for an efficient and easy to handle portal for its Geographic Information System.

Integrated management of *Oryctes* and other pests

- Preparation of a specific R&D programme to control the *Oryctes rhinoceros* in the Socfindo estates in co – operation with the Cirad consultants and the industry
- Implementation of the biological control of *Oryctes rhinoceros* at Aek Loba

Since early 2006, a strain of virus affecting *Oryctes* larvae is maintained at Aek Loba. A full set of R & D will be implemented this year. A first set of observation is in implementation at Aek Loba to observe the possible outbreak of *Oryctes* from the chips produced by the new replanting procedures.

BOX IX:
The protocols concerning this programme will be sent soon by Cirad.

Integrated management of the fruit set

- Monitoring of the *Elaeidobius kamerunicus* population, preparation of a specific R&D programme to follow – up the seasonal variation of its population in co – operation with the Cirad consultants and the industry

BOX X:
This R&D operation is in implementation.

3.3.5. Research & Development programme for Environment, Social and Sustainability

Integrate the RSPO principles and criteria in the PT Socfindo management and field practices

- Preparation of the integration of the principles and criteria for SPO in the management and field practices at PT Socfindo
- Participation to the identification of the indicators needed to evaluate the SPO principles and criteria
- Participation to the implementation of ISO14000 procedure
- Participation in technical meetings, customer visits, etc, whenever useful or desired, at PT Socfindo' request

Integration of RSPO principles and criteria in the management and field practices will be prepared through a set of ISO certifications, which cover the fields of RSPO P & C. The TABLE 6 summarises the different aspects:

TABLE 6: RSPO Components and ISO certification

RSPO Components	Certification families
GMP – GAP - IPM	ISO 9000
Environment	ISO 14000
Health and Security	OHSAS 18000
Social	CSR?
Relationship with workers / communities - rules	?

BOX XI:
The Socfindo Programme for certification includes actually 3 programmes:

- Certification for ISO 9001 – 2000
- Certification for ISO 14001 – 2004
- Certification for OHSAS 18000

The programme concerns also the rubber estates and factories. Concerning the oil palm sector, the factory and the refinery complex at Tanah Gambus is ISO 9001 – 2000certified.
For the other oil palm estates, the ISO 9001 – 2000 certification of their mills should be achieved by 2011.
Operations for ISO 14001 – 2004 will start this year in all groups and should be achieved by 2014
Operations for OHSAS 18000 will start also in 2007 and be achieved also in 2014.

Concerning Social aspects, including relationship with the surrounding communities, contacts are already running with a certification advisory body to evaluate the best way to achieve this important point, which is less clearly monitored by the RSPO P & C and their guidance.

Develop new projects taking in account the Environment protection

- Participation to various projects (BACP, PanEco)

We are involved in the preparation of a project leaded by PanEco. This project, located in the Tripa swampy forest border would like propose the conversion of fallows to oil palm cultivation in order to preserve the Swampy Forest and its biodiversity. A pilot project of 100 ha is drafted.

3.3.6. Consultants missions

As summarised in Agenda above, Socfindo received Cirad consultants for a total of 121 mission days since July 2006. For many of them, consultant missions were coupled.

Dispatched by R&D programmes, the following table takes stock of theses missions.

R & D Programme	Consultant / Visitor	Number of missions	Coupled mission	Total number of expert days
Agronomy	JP Caliman	2		13
	J Ollivier	2	With JPC	21
Breeding and Seed Production	T Durand Gasselin	4		46
	C Picasso	1	With TDG	5
	B Cochard	2	1 coupled with TDG	32
	V Pomiès	1	With BC	9
Crop Protection	L Ollivier	2		16
	D Rochat (INRA)	1	With LO	5
Ganoderma CLSA / Scopa	H de Franqueville	2		23
			Total	170

Socfindo received 2 missions for 21 days, accumulating 34 expert days for agronomy, 5 missions for 60 days, accumulating 92 expert days for breeding, 2 missions for16 days – but 2 years missions, accumulating 21 expert days for crop protection and 2 missions, accumulating 23 expert days for Cirad-Lonsum-Socfindo Agreement (CLSA) and Scopa. In addition, Socfindo received ITK mission (3 experts), coupled with T Durand-Gasselin's mission last April.

BOX XII:
It will be useful for saving Socfindo Staffs and STA time, if the consultant missions could be concentrated on field visits, evaluation of projects, programmes and proposals than to computerise data, information or results. These last activities should be fulfilled before the mission through exchange of data by emails.
We would like back to 1 consultant per programme and a maximum of 2 missions per year policy with 1 month for breeding, 1 month for agronomy, 15 days for Crop protection and 15 days for Ganoderma. Thus, a total of 90 days of missions should be sufficient.

3.3.7. Conferences, publications, E-presentations, and general reports

Conferences, visits

Field visit at United Plantation Malaysia (Teluk Anson, September 2006)
RSPO Round Table 4 (Singapore, November 2006)
International Agriculture Exhibition (Paris, March 2007)
Socfindo's Tenera Gathering & Tours 2007 (Medan, PSBB and Aek Loba, June 2007)
PT Socfindo Workshop (Medan, June 2007)

Publications

BASKETT, JPC; WILLIAMS, HO and JACQUEMARD, CH (2006). "Communication presented to 15th International Oil Palm Conference - Opportunities for new positioning of Palm Oil in the World, Convention Center de Carthagena de Indias, Colombia, 19 - 22 September 2006

DURAND-GASSELIN, T; HAYUN, Z; JACQUEMARD, JC; INDRA, S; ADJE, I; FLORI, A and NOUY, B (2007). "Palm oil yield potential of oil palm (Elaeis guineensis) seeds developed in a network by Cirad and its partners". Presented to International Seminar on Yield Potential in the oil palm – ISOPB – Phucket, Thailand, 27 – 28 November 2007

JACQUEMARD, JC (2007). "Sustainability of the Oil Palm Productivity". Communication to 2007 SIA – Oil Palm Conference: Sustainability of Palm Oil production: researches need, Paris, France, 5 March 2007

HABIB, R; NICOLAS, D; JACQUEMARD, JC and OMONT, H (2007). "Commodities in a global vision for agriculture towards 2100". 2007 Conference on plantation commodities, 3 -4 July 2007, Putra World Trade Centre, Kuala Lumpur, Malaysia.

JACQUEMARD, JC and HAYUN ZAELANIE (2007). "How to choose the best planting material to obtain a maximal crop". Communication to Socfindo's Tenera Gathering & Tours 2007 (Medan, PSBB and Aek Loba, June 2007)

JACQUEMARD, JC (2007). "R&D Programme for breeding at PT Socfindo". Communication to Socfindo's Tenera Gathering & Tours 2007 (Medan, PSBB and Aek Loba, June 2007)

For next PIPOC 2007:

BASKETT, JPC; JACQUEMARD, JC; DURAND-GASSELIN, T; EDYANA SURYANA, HAYUN ZAELANIE and EKO DERMAWAN (2007). "Planting material as key input for sustainable palm oil".

E-presentations (slide-show)

Aek Kwasan II project (November 2006)
PT Socfindo Research & Development programme (February 2007)
Aek Loba Timur genetic block: overview, last results and consequences (February 2007)
How to choose the best planting material (June 2007)
PT Socfindo R & D programme for breeding (June 2007)
Sustainability of the Oil Palm Productivity (March 2007)

Documents and general reports

2007 Fertilisation at Aek Loba Timur project
Procedures for ID project sampling
2006 Collection Transfer report
PT Socfindo R & D programmes for PT Socfindo website
PT Socfindo R & D programmes updated 2007
Aek Loba Timur breeding block: overview and last results – version 2007/02
PT Socfindo planting material: some commercial figures – version 2007/02
R & D for field practices: fruit set and harvesting problems
2005 Parental garden planting

3.4. Work schedule for 2007 / 2008

This work schedule for 2007 / 2008 presented has been reviewed according the new presentation of the PT Socfindo Research & Development programmes. There is basically no significant difference with the 2006 / 2007 programme

3.4.1. Research & Development programme for Agronomy and Field Practices

Support to fertilisation programme

- Support in steering the commercial fertilisation programme
- Assistance to the implementation of new agronomy trials
- Monitoring of the specific observation programme in the concerned agronomy experiments at Aek Loba Estate (ALCP 61, ALCP62, ALCP09)

Field practices, plantation management and mill processing

- Monitoring of the ripeness criteria through specific experiments
- Monitoring of the "Pollinator trees" experiment
- Monitoring of the improvement of the manual assisted pollination
- Support and assistance for the implementation of the GIS programme at PT Socfindo
- Monitoring of the Oil Extraction Rate at Aek Loba Estate through specific experiments
- Monitoring of the improvement of the control of *Mucuna bracteata*

Improvement of the mineral nutrition knowledge of the future planting material

- Monitoring of the ALT Genetic Block fertilisation programme in co – ordination with Agricultural Department and Cirad consultants

3.4.2. Research & Development programme for Breeding and Seed Production

Variety creation

- Breeding programme
    - Monitoring of the crossing maps in co – operation with Cirad consultants
    - Monitoring of the observation related with the MAS programme (ALGP29)
- Aek Loba Timur genetic bloc

  - Monitoring of the Aek Loba Timur Genetic Block activities
  - Monographs of ALGP04
  - Monographs of ALGP06 to ALGP10
- Aek Kwasan II project
  - Monitoring of the operations (work programme, germination, prenursery, nursery, field preparation, plantation) with all involved operators (Head Office, PSBB, Aek Loba, Cirad)

Variety propagation

- PSBB
  - Follow-up and assistance in implementing the seed production programme (Bangun Bandar), respecting instructions specific to such production,
- Aek Kwasan II
  - Preparation of the transfer of the seed production activities to Aek Loba
  - Implementation of the new seed garden
- Participation to the new Vegetative Propagation laboratory creation

3.4.3. Research & Development programme for Crop Protection

Integrated management of the BSR

- Follow – up and assistance to the observation in the Gano 1, Gano 2 and Gano 3 located at Mata Pao, Bangun Bandar and Tanah Gambus
- Monitoring of the observation in the Aek Loba Timur Genetic Block

Integrated management of *Oryctes* and other pests

- Preparation of a specific R&D programme to control the *Oryctes rhinoceros* in the Socfindo estates in co – operation with the Cirad consultants and the industry
- Implementation of the biological control of *Oryctes rhinoceros* at Aek Loba

Integrated management of the fruit set

- Monitoring of the *Elaeidobius kamerunicus* population, preparation of a specific R&D programme to follow – up the seasonal variation of its population in co – operation with the Cirad consultants and the industry

3.4.4. Research & Development programme for Environment, Social and Sustainability

Integrate the RSPO principles and criteria in the PT Socfindo management and field practices

- Preparation of the integration of the principles and criteria for SPO in the management and field practices at PT Socfindo
- Participation to the identification of the indicators needed to evaluate the SPO principles and criteria
- Participation to the implementation of ISO14000 procedure
- Participation in technical meetings, customer visits, etc, whenever useful or desired, at PT Socfindo' request

Develop new projects taking in account the Environment protection

- Participation to various projects (BACP, PanEco)

3.4.5. Publications, Conferences and general reports

In first priority: the R&D report

Annex 1

Scientific & Technical Adviser Agenda

Scientific & technical Adviser Agenda for 2006 second semester

Day	July	Holl	AL	Leave	Visits	August	Holl	AL	Leave	Visits	Sep	Holl	AL	Leave	Visits	Oct	Holl	AL	Leave	Visits	Nov	Holl	AL	Leave	Visits	Visits	Dec	Holl	AL	Leave
S																1														
M																2														
T						1										3														
W						2										4					1									
T						3										5			MES>AL		2									
F						4					1			AL>MES		6			MES	JO	3						1		MP > I	LO+RCH
S	1					5					2			MES>AL		7			MES	JO	4						2		MES	LO+RCH
S	2		Agrimas		TDG	6					3					8			MES	JO+JPC	5						3		MES >	AL
M	3		TDG		TDG	7					4					9			MES>MP	JO+JPC	6				HDF		4			
T	4		TDG		TDG	8					5					10			BB	JO+JPC	7				HDF		5			
W	5		TDG		TDG	9					6			AL>MES		11			BB>TG	JO+JPC	8			AL>MES	HDF	TDG+BC	6			
T	6			AL>ME:	TDG	10					7			MES>KL		12			TG	JO+JPC	9			MES; MP	HDF	TDG+BC	7			AL>MES
F	7			MES	TDG	11					8			UP		13			TG>MES	JO+JPC	10			BB; MES	HDF	TDG+BC	8			MES>SIN>CDG
S	8			AL>ME:	TDG	12					9			KL		14			MES	JO+JPC	11			MES; ME	HDF	TDG+BC	9			
S	9			MES>SG		13					10			KL>MES		15			MES>AL	JO	12				HDF	TDG+BC	10			
M	10			SG>CDG		14					11			PSBB		16				JO	13		BC		HDF	TDG+BC	11			
T	11	Paris				15					12			PSBB > AL		17				JO	14		BC		HDF	TDG+BC	12			
W	12	Paris				16					13					18				Dr Tuk	15		BC	AL>MES	HDF	TDG+BC	13			
T	13					17					14					19			AL>MES	Dr Tuk	16			MES	HDF	TDG+BC	14			
F	14					18					15					20			MES	Dr Tuk	17			PSBB		TDG+BC	15			
S	15					19					16					21			MES		18			PSBB; PSBB > I		TDG+BC	16			
S	16					20	CDG>SG				17					22					19			MES		TDG+BC	17			
M	17			BES>MPL		21			SG>MES		18					23					20			MES > SIN		TDG+BC	18			
T	18			MPL		22			MES		19					24					21			RT4		TDG+BC	19			
W	19			MPL		23			MES>AL		20					25					22			RT4		TDG+BC	20			
T	20			MPL		24					21					26					23			SIN>MES		TDG+BC	21			
F	21			MPL>BES		25					22					27					24			MES; MES>AL		TDG+BC	22			
S	22					26					23					28					25						23			
S	23					27					24			AL>MES		29					26						24			
M	24					28					25			MES		30			MES		27						25			
T	25					29					26			MES>AL		31			MES > AL		28			AL >TG		LO+RCH	26			
W	26					30		Visit		Rahim	27										29			TG		LO+RCH	27			
T	27					31					28										30			MP		LO+RCH	28			
F	28										29																29			
S	29										30																30			
S	30																										31			
M	31																													

Holiday | Aek Loba | Aek Loba with visitors | Outside Aek Loba | Visitors' code

Scientific & Technical Adviser Agenda for 2007 first semester

Day	January	Holl	AL	Leave	February	Holl	AL	Leave	Visits	March	Holl	AL	Leave	Visits	April	Holl	AL	Leave	Visits	Visits	May	Holl	AL	Leave	Visits	June	Holl	AL	Leave	Visits		July	Holl	AL	Leave	Visits
S															1			MES>	JO	TDG/ITK												1			CDG>MPL	
M	1														2				JO	TDG/ITK												2			MPL	
T	2														3			AL>MES		TDG/IT	1			Labor day								3			MPL	
W	3														4			PSBB		TDG/IT	2											4			SCOPA	
T	4				1				Socfinco	1			AL>MES		5			MES>AL		TDG/IT	3											5			SLC Gano	
F	5				2					2			MES>CDG		6			Good Friday		TDG	4					1			MES			6			MPL>CDG	
S	6				3				TDG	3			Paris		7					TDG	5					2			MES>AL			7				
S	7				4				TDG	4			SIA		8					TDG	6			AL > PSBB		3						8			CDG>SIN	
M	8				5				TDG	5			SIA		9			Easter	Monda	TDG	7			PSBB; BB > M		4						9			SIN>MES	
T	9				6				CP/TDG	6			SIA		10					TDG	8			MES > AL		5						10			MES	
W	10				7			AL>TG	CP/TDG	7			SIA>MPL		11			AL>MES		TDG	9					6						11			MES>AL	
T	11				8			TG>PSBB>	CP/TDG	8			MPL		12			MES		TDG	10					7			MES	BC		12				
F	12				9			MES	CP/TDG	9			MPL>Paris		13			MES>AL		TDG	11			AL>MES		8			MES	BC		13				
S	13				10			MES	CP/TDG	10			CDG>SIN		14						12			MES		9			MES >	BC		14			National day	
S	14				11			MES>AL		11			SIN>MES		15						13			MES>SIN>CI		10				BC		15				
M	15				12					12			MES>AL		16						14					11			AL > M	BC	HdF	16				
T	16				13					13					17						15					12			MES>	BC	HdF	17				
W	17				14					14					18			AL>MES		LO	16					13				BC/VF	HdF	18				
T	18				15			AL>PSBB		15					19			MP		LO	17			Ascension		14			AL > T	BC/VF	HdF	19				
F	19				16			PSBB; PSBB > MES		16					20			MP>AL		LO	18					15			TG	BC/VF	HdF	20			AL>MES	
S	20				17			MES; MES > AL		17					21			AL		LO	19					16			TG > A	BC/VF	HdF	21			MES>SIN>CI	
S	21				18			Chinese new year		18					22			AL		LO	20					17				BC/VF	HdF	22				
M	22				19					19			Nyepi		23			AL		LO	21					18				BC/VF	HdF	23				Dr Val
T	23			CDG>SIN	20			AL>MES		20					24			AL>NL		LO	22					19			AL > M	BC/VF	HdF	24				
W	24			SIN>MES	21			MES>PSBB	Mukesh PS	21					25			NL>AL		LO	23					20			MES V	BC/VF	HdF	25				
T	25			MES	22			PSBB>AL	Mukesh PS	22					26			AL>MES		LO	24					21			MES V	BC/VF	HdF	26				
F	26			MES>PSE	23				Mukesh AL	23			MES>AL		27			MES		LO	25					22			Worshop Soc		HdF	27				
S	27			MES>AL	24				Mukesh AL	24			MES		28			MES>AL		LO	26					23			Worshop Soc			28				
S	28				25				Mukesh > M	25			MES	JO	29						27					24			MES >	AL		29				
M	29				26				Mukesh	26		Rah	MES>AL	JO/JP	30						28					25						30				
T	30				27					27				JO/JPC>NL							29					26						31				
W	31				28					28				JO/JPC							30			CDG>SIN		27										
T										29				JO/JPC							31			SIN>MES		28			AL>MES							
F										30			AL>PP>ME	JO/JPC												29			MES							
S										31			Maulid al-Na	JO/JPC/TDG												30			MES>CDG							
S																																				

Holiday | Aek Loba | Aek Loba with visitors | Outside Aek Loba | Visitors' code